

APPARATUS AND METHOD FOR EXCHANGING HEAT

## BACKGROUND OF THE INVENTION

## FIELD OF THE INVENTION

5           The present invention relates to a heat-exchange apparatus, in general, and to a spiral shape heat-exchange apparatus, in particular.

## DISCUSSION OF THE RELATED ART

Heat exchangers of different sizes and shapes are known in the art, such examples are plate type, shell and tube, and fin Heat exchangers. Common objectives considered for Heat exchangers construction are economy of manufacture, efficiency of heat transfer, safety and long service life. The basic construction of heat exchangers is aimed to optimize the heat exchange between a cool fluid and a hot fluid. Wherever fluids are mentioned, it could also include Air. Optimization of heat transfer within heat exchangers is a broad subject for scientists as well as engineers. Among the important parameters tested to reach optimization of heat exchangers are the temperature of the inlet fluids, the volume capacity of the fluids per time interval, the contact surface between the fluids, the fluid used, building materials of the heat exchanger, the temperature required for the outlet fluid and others. A change of value of one of the said parameters can have a significant influence on the operating performance of heat exchangers. Heat exchangers are commonly constructed as to have a bi-directional fluid flow in order to increase performance efficiency of the heating or cooling process. Thus, bi-directional heat exchangers provide a faster and usually energy saving manner of reaching a temperature requested of a desired fluid. Specifically, heat exchangers known in prior art, such as a shell and tube heat exchangers and others, include a first fluid that flows from one chamber to another chamber through bypass or cross-flow conduits, so as to exchange heat with a second fluid flowing in the passages of adjacent, heat-conductive conduits. Characteristically, a coolant fluid is the first fluid, the second fluid being atmospheric air.

Alternatively, the second fluid is typically available in large quantities at substantially low cost, for use in bulk flow heat exchangers, such as water. Usually, the cooling or heating fluid flows within a U shape conduits. The U shape fluid flow provides more surface contact with the coolant fluid in order to permit additional heat to be absorbed. However, the U shape flow decreases the flow capacity of the fluid, subject to the U shape, which demands an 180° angel, turn of the fluid. Thus, a large capacity fluid flowing in a U shape conduit causes the eruption of friction forces that slow the fluids flow within conduit by causing turbulence flow and consequently, undesirable pressure within heat exchangers.

Thermoelectric chips for heating and cooling based on the Peltier effect are known within the prior art. A thermoelectric layout is constructed of semi-conducting materials, such as bismuth telluride, that are electrically connected in parallel and/or series. When an electric current is connected to the circuit, a heat gradient is created, thus, heat is absorbed at the cold junction of the circuit and is transferred to the hot junction of the circuit. By inserting the hot and cold junctions within a heat exchanger, heat can be transferred from one fluid flow stream to another. Classically, a heat exchanger is filled with either gas or liquid fluid, resulting in the heating of one fluid and the cooling of the other fluid. The use of thermoelectric chips within heat exchangers in prior art is usually limited to particular uses, such as small capacity per time interval heat exchangers units or for delicate heat exchangers constructional conditions. The reasons for the limited use of thermoelectric chips are due to the fact that chips have a delicate construction and use electrical current for their operation. Using thermoelectric chips within rigid conditions can damage the construction of the chips consequently, decreasing the heat transfer capability of the heat exchanger. Due to the use of electric current to activate thermoelectric chips cooling or heating of explosive fluids can be hazardous. Nevertheless, the use of thermoelectric chips can provide efficient heat transfer when intelligently implemented within heat exchangers. There is a need in the art for a facility that will provide efficient performance of heat transfer in comparison to other heat exchangers of the same

capacity. Furthermore, there is a need in the art to facilitate heat exchangers devices that are simple and can be easily optimized and minimizes energy loses due to mechanical flow of the fluids. Furthermore, there is a need in the prior art for a conditioning unit that will have a minimal size and weight that require  
5 minimal energy yet providing relatively large capacity of conditioning (e.g. of air). Thus, providing conditioning units for systems wherein reaching a minimal size, weight and energy consumption is vital. Said systems that require air conditioning units can be racing cars.

## SUMMARY OF THE PRESENT INVENTION

The present invention provides a new and novel apparatus and method for fluid conditioning.

One aspect of the present invention regards an apparatus for exchanging  
5 heat, the apparatus comprising, a conduit having a spiral shape for conditioned fluid to flow through, a heat sink compartment that will be related below as the heat transfer unit of the coolant fluid compartment, a chip layout comprising a thermoelectric unit positioned between the conduit and the heat sink compartment such that one surface of the array is in contact with the fluid conduit and the  
10 second surface is in contact with the heat sink compartment. The heat sink compartment is a conduit having an inlet and an outlet for allowing a fluid to flow through. The apparatus may further comprise a motor and a first fan connected to the motor for driving the fluid to be conditioned through the spiral-shaped fluid conduit. The apparatus may further comprise a second fan for driving fluid through  
15 the heat sink compartment, the motor is a double-shaft motor having two opposite coaxial spinning shafts and the first and second fans are connected each to one of the two opposite shafts. The motor is located at the heat sink compartment. The fluid to be conditioned or driven through the heat sink could be air or water. The spiral shaped fluid conduit comprises a rounded thermally conductive base plate,  
20 the plate is in contact with one surface of the thermoelectric layout; and walls perpendicular to the plate, the walls forming a spiral path. The first fan is positioned at the center of the spiral path. The spiral path is provided with a plurality of pin fins perpendicularly protruding from the plate. The apparatus may be used as a fluid conditioner for directing conditioned fluid to a specific location  
25 through a conduit connected to the outlet of the spiral shaped conduit.

A second aspect of the present invention regards a heat exchange apparatus for use as a compact air-conditioning unit, the apparatus comprising a spiral-shaped conditioned-air compartment having a first inlet and a first outlet, a heat sink compartment having a second inlet and a second outlet, a thermoelectric array  
30 comprising a thermoelectric chip, positioned between the conditioned-air

compartment and the heat sink compartment, such that when electric current is passed through the array a temperature gradient is formed between the conditioned air compartment and the heat sink compartment, a motor having two opposite coaxial spinning shafts; and two fans mounted each on one of the two opposite shafts such that one fan is mounted in the conditioned air compartment for driving ambient air through the first inlet, and the second fan is mounted in the heat sink compartment for driving ambient air through the second inlet. The conditioned air compartment comprises a first heat transfer unit fabricated from a thermal conductive material, the heat transfer unit comprises a base plate and perpendicular walls forming a spiral path and wherein the first inlet and the first outlet are located at the inner end and the outer end of the spiral path, respectively. The motor is mounted inside the heat sink compartment such that heat generated during operation of the motor is transferred to the air flowing through the heat sink compartment.

Yet, another aspect of the present invention regards a method for conditioning fluid by a heat exchange apparatus, the method comprising driving a first fluid to be heated or cooled through a first compartment of a heat exchange apparatus, the compartment comprises a spiral shape path, driving a second, coolant or heating, fluid through a second compartment of the heat exchange apparatus, activating a layout comprising a thermoelectric chip for forming a temperature gradient between two surfaces of the array, wherein one surface is in contact with the first compartment and the second surface is in contact with the second compartment. The motor serves for driving both the first fluid and the second fluid through the first and the second compartments, respectively. The motor is provided with two opposite coaxial spinning shafts and wherein a first and second fan, are mounted each on one of the two shafts such that the first fan draws the first fluid through the first compartment and the second fan draws the second fluid through the second compartment.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

5 Fig. 1A is an overall view of heat exchangers in accordance with a preferred embodiment of the present invention;

Fig. 1B depicts the different components of the heat exchangers of a preferred embodiment of the present invention;

10 Fig. 2A is a perspective view of an open heat transfer unit of the conditioned fluid compartment within a heat exchanger of the preferred embodiment of the present invention;

Fig. 2B is a cross section through the heat transfer unit of the conditioned fluid compartment of Fig. 2A;

15 Fig. 3A is a perspective view of an open heat transfer unit of the coolant fluid compartment within a heat exchanger of the preferred embodiment of the present invention;

Fig. 3B is a cross section through the heat transfer unit of the coolant fluid compartment of Fig. 3A;

20 Fig. 4 is a profile view of a motor and rotate-ably mounted fans within a heat exchanger of the preferred embodiment of the present invention;

Fig. 5 is a schematic illustration of a thermoelectric chips layout within a heat exchanger of the preferred embodiment of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention provides an innovated concept of operation for heat exchangers, a distinctive profile of construction of heat exchangers and exploitation of thermoelectric chips as heat transferring means. The present invention provides a heat exchanger that optimizes the heat transfer process, thus, providing a simple yet high capacity efficient heat exchanger. The present invention provides a heat exchanger having a spiral shaped conditioning compartment enabling the heat exchanger to be small and more efficient than previous heat exchangers. Furthermore, the heat exchanger of the present invention comprises a single motor unit for performing the inlet and outlet of conditioned and coolant fluids allowing a more compact and efficient heat exchanger. The use of the particular design enables a more efficient cooling/or heating while consuming less energy. The use of one motor in association with a spiral shape heat exchanger also results in a better heat exchange in high volume of conditioned fluid exchange. The present invention will be better understood during the depiction of the following drawings that illustrate the preferred embodiment of the present invention.

Fig. 1A presents the preferred embodiment of the present invention. The heat exchanger designated 10 presents a spiral exterior shape of the innovative heat exchanger 10. The coolant fluid enters and leaves heat exchanger 10 through inlet 16 and outlet 14, respectively. The conditioned fluid outlet is designated 12. The inlet of the conditioned fluid that is placed on the same axis line of the coolant fluid inlet 16 is not shown in Fig. 1A. One skilled in the art can easily comprehend that, though, the preferred embodiment, depicted in view of the drawings, refers to conditioning air by a coolant that is air, it is by no means limited to the mentioned example. The fluids used within the heat exchanger 10 can be of any sort without any limitation of physical state of the fluid. Thus, the coolant or the fluid to be conditioned can be any physical state, liquid or gas, requested by a user.

Fig. 1B illustrates in a de-assembled manner the components that consist heat exchanger 10 according to the preferred embodiment of the present invention. One skilled in the art can foresee that the elements illustrated within Fig. 1B are presented in order to comprehend the present embodiment alone and do not limit the scope of the present invention. Heat exchanger 10 is comprised from a coolant fluid compartment 50 also referred to as a heat sink compartment, a conditioned fluid compartment 52, a motor 42 and thermoelectric chips layout 30. The coolant fluid compartment 50 is comprised from a coolant inlet 16, a coolant cover 20, a fan cover 22, a sealing cover 24, a heat transfer unit 26 and a fluid fan 28. The coolant fluid outlet 14 is presented in Fig. 1A is viewed at the coolant cover 20 viewed in Fig. 1B. The coolant inlet 16 is in the central part of the coolant cover 20. Heat transfer unit 26 and the coolant insertion section are described below in conjunction with Figs. 3A and 3B. The coolant cover 20 covers the entire coolant fluid compartment 50, thus, determining the size of the coolant fluid compartment 50. The fluid fan 28 draws the coolant fluid to the coolant fluid compartment 50. The coolant fluid enters the coolant fluid compartment 50 through the coolant inlet 16. The fan cover 22 is positioned on the top part of the fluid fan 28 thus, fixing the position of fluid fan 28 and not allowing the coolant fluid to exit from the space between the coolant fluid cover 20 and the fluid fan 28. The fluid fan 28 is positioned in the center part of the coolant fluid compartment 50, a better view of the fluid fan's 28 position in relation to the coolant fluid compartment 50 is viewed in Fig. 3B. The fluid fan 28 relation to the motor 44 and to the suction fan 44 will be depicted in view of Fig. 4 bellow. The sealing cover 24 prevents the exit of the coolant fluid from the coolant fluid compartment 50 other than the coolant outlet section 14 illustrated in Fig. 1A. The heat transfer unit 26 is positioned above the thermoelectric chips layout 30 and contains fins that aid efficient heat exchange toward the coolant fluid. Thus according to the preferred embodiment of the present invention the coolant (e.g. air) exchanges heat with the fins positioned within the heat transfer unit 26. The fins 70 are depicted and illustrated more closely in Figs. 3A and 3B



below. The thermoelectric chips layout 30 is positioned under the coolant heat transfer unit 26 and over the conditioned heat transfer unit 32. The terms “under” and “over” used within the depiction of the drawings are in accordance to the illustrations shown and by no means are limiting the scope of the present invention. The conditioned fluid compartment 52 is comprised from a conditioned fluid inlet 48, a conditioned fluid compartment cover section 40, a sealing cover 38, an insulation cover for suction fan 36, a suction fan cover 34, a heat transfer unit 32 and a suction fan 44. The thermoelectric chips layout 30 is positioned between the coolant heat transfer unit 26 and the conditioned fluid heat transfer unit 32. The conditioned fluid enters the conditioned fluid compartment 52 through the conditioned fluid inlet 48. The conditioned fluid chosen to illustrate the preferred embodiment of the present invention is air. The conditioned fluid inlet 48 is positioned in the central part of the conditioned fluid compartment cover section 40. According to one preferred embodiment of the present invention the diameter of the conditioned fluid inlet is approximately 30% longer than the diameter of suction fan 44. A better perspective of the conditioned fluid inlet 48 position is provided in Figs. 2A and 2B. The conditioned fluid compartment cover section 40 covers the entire conditioned fluid compartment 52, thus, determining the size of the conditioned fluid compartment 52. The sealing cover 38 prevents the conditioned fluid to exit from the heat transfer unit 32 other than the coolant outlet section 12 illustrated in Fig. 1A. The insulation cover 36 for suction fan 44 prevents thermal exchange from the heat transfer unit 32 through the opening of the suction fan 44. As can be viewed in Fig. 1B the heat transfer unit 32, suction fan cover 34 as well as insulation cover 36 (not shown) include a hole enabling the positioning of the fan connecting pivot 82 depicted below in view of Fig. 4. The suction fan cover 34 besides sealing the exit of conditioned fluid from the heat transfer unit 32 also stabilizes the position of the suction fan 44 by eliminating mechanical stress from the motor assembly. The heat transfer unit 32 is positioned under the thermoelectric chips 30 and contains fins that aid efficient heat transfer from the conditioned fluid towards the coolant fluid. The fins 60 are

depicted and illustrated more closely within Figs. 2A and 2B below. The suction fan 44 sucks the fluid to be conditioned into the conditioned fluid compartment 52. The suction fan 44 will be depicted in view of Fig. 4 below. The thermoelectric chips layout 30 is positioned above the heat transfer unit 32 and under the coolant fluid compartment heat transfer unit 32. The motor 42 is positioned according to the preferred embodiment within the center of heat transfer unit 26 within the coolant fluid compartment 50. More specifically the motor 42 is positioned within the center of the inlet section 72 as viewed and depicted in regard to Fig. 3A below. The fluid fan 28 and the suction fan 44 are pivotally connected to the motor 42. The motor's 42 position and the fact that the fluid fan 28 and the suction fan 44 are pivotally connected provide a unique construction of HE 10. The motor 42 provides dual functionality within heat exchanger 10 as presented according to the preferred embodiment. The motor 42 is functioning as the driving force of the incoming coolant fluid at the coolant inlet 16 and is functioning as the driving force of the inserted fluid to be conditioned at the conditioned fluid inlet 48. The dual functionality of the motor 42 saves space and enables to achieve optimization of the energy and efficient energy exploitation within the preferred embodiment as well as minimizing the energy consumption of heat exchanger 10. The conditioned fluid compartment 52 is positioned on the opposite side of the coolant fluid compartment 50.

The preferred embodiment of heat exchanger 10 is a cooling apparatus; accordingly, the heat is transferred from the conditioned fluid to the coolant. The temperature gradient within heat exchanger 10 is formed by the Peltier effect performed by the thermoelectric chips layout 30. The surface coverage of the thermoelectric chips layout 30 is further discussed in view of Fig. 5. The conditioned fluid enters the conditioned fluid compartment 52 and the heat is transferred from the conditioned fluid to the fins 60 (Fig. 2B) within the heat transfer unit 32 and the base of the heat transfer section 64 (Fig. 2B). The thermoelectric chips layout 30 by exploiting the Peltier effect indicates the direction of the heat flow from the conditioned fluid to the coolant. Thus,

motivating and directing the heat transfer direction. Hence, the heat transfer within the preferred embodiment is directed from the conditioned fluid compartment 52 towards the coolant fluid compartment 50. The said fins transfer the received heat to the coolant fluid compartment 50 through the thermoelectric chips layout 30 to the heat transfer unit 26 within the coolant fluid compartment 50. An exchange of the heat within heat transfer unit 26 is performed from the fins 70 (Fig. 3B) and heat transfer section base 74 (Fig. 3B) to the coolant fluid within the heat transfer unit 26. The coolant within the heat transfer unit 26 transfers the heat from the heat exchanger 10 at the outlet 14 shown in Fig. 1A.

Figs. 2A and 2B present a layout of the heat transfer unit 32 within the conditioned fluid compartment 52. Accordingly, Fig. 2A presents the spiral path that the conditioned fluid goes through within the conduit of heat transfer unit 32. The fluid to be conditioned within the heat transfer unit 32 within the preferred embodiment of the present invention is drawn by means of fan 44 through the center of the heat transfer unit 32 at the conditioned fluid inlet 62. The conditioned fluid exits the heat transfer unit 32 at the conditioned fluid outlet 12 (Fig. 1A). The suction fan 44 (Fig. 1B) draws said fluid to the heat transfer unit 32 and the conditioned fluid flows through the heat transfer section conduit to the conditioned fluid outlet 12 (Fig. 1A). Due to the spiral shape of the conduit of the heat transfer unit 32, as illustrated within Fig. 2A, the fluid flows through a long way, thus, enhancing the heat transfer rate from the conditioned fluid to the fins 60 the thermoelectric chips 30 to the fins 70 within the coolant fluid compartment 50. The fins 60 within the heat transfer unit 32 improve the heat transfer from the conditioned fluid to the coolant by erupting the flow of the conditioned fluid. A temperature gradient within the heat transfer unit 32 exists between the conditioned fluid and the fins 60 due to the fact that the fin's 60 base are connected to the base of the heat transfer section 64 (Fig. 2B). The base of the heat transfer section 64 is in contact with the cool side of the thermoelectric chips layout 30 (Fig. 1B). The thermoelectric chips layout 30 using the Peltier effect creates a temperature gradient that according to the preferred embodiment enables

exchange of heat from the heat transfer section base 64 to the heat transfer unit 26 within the coolant fluid compartment 50. The heat transfer unit 26 is positioned in contact with the hot side of the thermoelectric chips layout 30 (Fig. 1B). The heat exchange within the heat transfer unit 26 provides the exchange of the heat by the coolant fluid within the heat transfer unit 26. Consequently, the heat received from the conditioned fluid exits HE 10 (Fig. 1B) with the coolant flow at the coolant outlet 14 (Fig. 1A). The heat gradient within the heat transfer unit 32 as well as heat transfer unit 26 varies along the progress of the conditioned fluid and the coolant fluid due to the exchange of heat executed along the flow of the fluid from its insertion to the conditioned fluid outlet 12 (Fig. 1A) and the coolant outlet 14 (Fig. 1A). The spiral flow movement within heat exchanger 10 (Fig. 1B) of the conditioned fluid within the heat transfer unit 32 facilitates improved exchange possibilities in comparison to other heat exchangers known in the art. The flow of the conditioned fluid in a spiral course minimizes the flow disturbances compared to known parallel heat exchangers, having the same capacity of conditioned fluid, same temperature difference of inlet and outlet of conditioned fluid. Furthermore, improved exchange of heat within the heat exchanger of the preferred embodiment is reached due to the use of the thermoelectric chips layout 30 (Fig. 1B). The thermoelectric chips layout 30 creates a temperature gradient between the coolant fluid compartment 50 and the conditioned fluid compartment 52. The improved heat exchange capabilities of heat exchanger 10 of the preferred embodiment enables to provide a small size heat exchanger 10 for performing the conditioning of a required fluid capacity. The size of heat exchanger 10 provided in the preferred embodiment is considerable smaller and requires less energy consumption in comparison to usage for a commonly used shell and tube heat exchanger that provides the same capacity and conditioning of a given fluid with the same coolant. Furthermore, as illustrated in Fig. 4 heat exchanger 10 includes only one motor 42 used for both the inlet and outlet of conditioned fluid and coolant fluid. The improved exchange offered within the preferred embodiment of the present invention along with the

use of only one motor 42 for performing the inlet and the outlet of the conditioned and coolant fluids provide a compact heat exchanger unit that supplies conditioned fluid.

Figs. 3A and 3B illustrate the heat transfer unit 26 within the coolant fluid compartment 50 (Fig. 1B). The heat transfer unit 26 includes the inlet section 72, the outlet section 14 (Fig. 1A), fins 70 and the heat transfer section base 74 (Fig. 3B). The inlet section 72 is positioned within the preferred embodiment in the center of the heat transfer unit 26 as viewed in Fig. 3B. The heat transfer unit 26 includes fins 70 that improve the heat exchange to the heat transfer section base 74 that is positioned above the thermoelectric chips layer 30 (Fig. 1B). Similar to the function of fins 60 within the heat transfer unit 32 (Fig. 2A) depicted above, the fins 70 (Fig. 3A) enable efficient exchange of heat within the preferred embodiment from the conditioned fluid to the coolant fluid. The temperature gradient exists from the conditioned fluid within the heat transfer unit 32 (Fig. 2A) within the conditioned fluid compartment 52 through the fins 60 (Fig. 2A), the heat transfer section base 64 (Fig. 2B), the thermoelectric chips layout 30 (Fig. 5), the heat transfer section base 74 (Fig. 3B) within the coolant fluid compartment 50, the fins 70 (Fig. 3A) and the coolant fluid. The said temperature gradient is different and is subject to the temperature of the fluids, conditioned and coolant, at every point along their course within heat exchanger 10 (Fig. 1A) of the preferred embodiment. Nevertheless, the said temperature gradient, initiated by the Paltier effect by the thermoelectric chips layout 30, motivation derives a rapid and efficient heat transfer from one fluid to the other within the preferred embodiment of the present invention. The coolant, within the coolant fluid compartment 50, according to the preferred embodiment, transports the heat received from the conditioned fluid, within the conditioned fluid compartment 52, by means of exchange through the fins 60, 70 (Fig. 2A, Fig. 3A, respectively), the heat transfer section base 64, 74 (Fig. 2A, Fig. 3A respectively) and the thermoelectric chips layout 30. The outlet 14 (Fig. 1A) is the place the coolant leaves the heat exchanger transferring heat from the conditioned fluid.

The thermal calculation (i.e. the heat capacity for transferring from conditioned fluid) for supplying required conditioned fluid capacity at a particular temperature is based on the coolant capacity. The thermal calculation according to the preferred embodiment takes into account the heat transferring of the heat of motor 42 positioned within the coolant fluid compartment 50.

Fig. 4 illustrates the motor 42, a fluid fan 28, a suction fan 44, a fluid fan connecting pivot 80 and the suction fan connecting pivot 82. The motor 42 is positioned within the preferred embodiment in the center axis of the heat exchanger 10 (Fig. 1B) as depicted in view of Fig. 1B. The fluid fan 28 and the suction fan 44 are rotate-ably connected to the motor 42. The fluid fan 28 within the preferred embodiment is a blower that draws coolant fluid (e.g. air) into heat exchanger 10. The suction fan 44 inserts the conditioned fluid to the heat exchanger 10. According, to the different functions of the said fans, the fluid fan 28 within the heat exchanger 10 is larger and includes more blades than the suction fan 44. Nevertheless, the different functions of the said fans does not prevent the economical and well operating pivotally connected operation on the same axis of fluid fan 28 and suction fan 44 within the preferred embodiment. The operating of fluid fan 28 and suction fan 44 provides an easily achieved optimized operation of heat exchanger 10, excludes the need for an additional apparatus to insert fluid and saves space within heat exchanger 10. Thus, the heat exchanger of the preferred embodiment has a smaller size and better capabilities in comparison to heat exchangers known in the art.

Fig. 5 illustrates the thermoelectric chips layout 30 within the preferred embodiment of the present invention. Accordingly, the thermoelectric chips layout 30 is positioned in a way that covers most of the surface area at the base of heat transfer sections of the conditioned fluid compartment 52 and the coolant fluid compartment 50. The surface covered by the thermoelectric chips layout 30 and the heat gradient created by the thermoelectric chips layout 30 increase the heat exchange between the conditioned fluid and the coolant fluid as described above

relating to Fig. 2A and Fig. 3A. Consequently, providing an efficient operation of the HE of the preferred embodiment.

Follows is an example of one particular embodiment of the present invention used for conditioning air and using air as the coolant fluid. Motor 42 is a 12V DC brushless motor manufactured by Kollmorgen having the following example characteristics:  $I_{\max}=7A$ ; motor length 28mm; Diameter 44mm; about 11,700 R.P.M. The fluid fan 28 has a diameter of 76mm and 28 blades and the suction fan 44 has a diameter of 32mm and about 10 blades. The fluid fan connecting pivot 80 length is 16mm and the suction fan connecting pivot 82 length is 18.90mm. The heat transfer unit 32 within the conditioned fluid compartment 52 and the heat transfer unit 26 within the coolant fluid compartment 50 are fabricated from an aluminum based alloy material containing zinc. The dimensions of the heat transfer unit 32 (as can be understood by viewing Fig. 2B) are as follows: length 192mm (upper part of base of the heat transfer section 64 to the lowest edge), width 180mm, length of the conditioned fluid inlet 62, 73mm (upper part of the inlet to lower part of the inlet) and the width is 52mm. The dimensions of the heat transfer unit 26 (as can be understood by viewing Fig. 3B) are as follows: length 192mm (upper part of base of the heat transfer section 64 to the lowest edge), width 180mm. The thickness of the base of the heat transfer section 64 is 8mm. The fins, designated 60 and 70 within heat transfer unit 32 and heat transfer unit 26 (Fig. 2A and Fig. 3A, respectively), are 32mm high. The said fins are distributed all over the heat transfer sections base and the distance between two neighboring fins ranges between 5 and 6mm. The sidewall of the heat transfer unit 26 and the sidewall and the inner spiral walls of the conduit of the heat transfer unit 32 have a width of 3mm. The thermoelectric chips layout 30 (Fig. 5) is combined from eight chips manufactured by Thermonamic Electronics (Xiamen Co. Ltd.) from China, Catalog No. TEC1-12704. The dimensions of a single chip is as follows 40X40X4.7 having  $I_{\max}=3.9amp.$ ;  $V_{\max}=15volts$ ;  $Q_{\max}=33.4Watt$ . The said chips within the particular embodiment are connected as follows, each couple of chips connected in series

and the 3 pairs connected in parallel. The coolant air influx within the particular embodiment is constant 140 CFM. The conditioned air inlet maximum influx is 18 CFM. The pressure within the heat transfer unit 32 at 0 CFM is 10" H<sub>2</sub>O and 2" H<sub>2</sub>O at 18 CFM. The results received within the operation of the said particular  
5 embodiment are as follows, the inlet air at 30<sup>0</sup> Celsius and 50% RH (relative-humidity) at the conditioned air inlet, the conditioned air outlet provides 17 Celsius, at 16-17 CFM. The person skilled in the art will appreciate that the above example is exemplary and tat the dimensions and measurements supplied are in no way limiting and serve merely to better describe the invention and enable a person  
10 skilled in the art to make and use the invention. Other like dimensions and measurements can be used to accomplish the objectives of the present invention.

The person skilled in the art will appreciate that what has been shown is not limited to the description above. Many modifications and other embodiments of the invention will be appreciated by those skilled in the art to  
15 which this invention pertains. It will be apparent that the present invention is not limited to the specific embodiments disclosed and those modifications and other embodiments are intended to be included within the scope of the invention. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation. The scope of the present  
20 invention is clearly defined by the claims that follow.